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ABSTRACT

A study was conducted in Alberta (Canada) to determine the feasibility of using mobile industrial education and home economics laboratories to provide on-site instructional facilities for junior high schools that do not have sufficient populations to warrant the construction of more permanent laboratories. Information was sought on the flexibility of such mobile units in terms of programs, the ease of mobility of the units, the durability of the units, the costs of investing in mobile units, and the extended costs of using the units. After investigation of these factors, it was decided that mobile laboratories have the potential to facilitate the delivery of similar educational opportunities to the less urbanized areas of the province. It was found that the possibilities extend beyond the industrial education and home economics programs at the junior high school level into many other courses where manipulative hardware is an integral part of the course. Examples of other subjects include typing, microprocessing, and the whole range of prevocational and vocational programs. Use of mobile laboratories is a viable delivery system; use of such a system is a matter of personal perspective. (KC)

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A STUDY INTO THE POSSIBLE USE OF MOBILE LABORATORIES FOR JUNIOR HIGH SCHOOL INDUSTRIAL ARTS AND HOME ECONOMICS

M. W. Tkachuk

Principal Investigator

County of Parkland

Contractor

THIS STUDY WAS MADE POSSIBLE

THROUGH FUNDING FROM THE PLANNING AND RESEARCH BRANCH

ALBERTA EDUCATION

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FOREWORD

This study was initiated in September 1981 in response to a need to provide industrial arts and home economics instruction on site at smaller rural junior high schools.

Further information not contained in the report is available, on loan, from the author.

Thanks are extended to Mr. John Arnot, Dr. J.D. Harder, Dr. W.E. Hathaway and Dr. W.P. Eddy for their constructive criticism during the development of the report. Appreciation is also expressed to Mr. D. Shaw, Mr. A. Eng, Mrs. B. Pakan and Lab Volt Ltd. for their technical input into the data base used for the study.

M.W.T.

TABLE OF CONTENTS

Page

INTRODUCTION 1

PURPOSE OF THE STUDY 2

DEFINITION OF TERMS 3

SCOPE OF THE INVESTIGATIONS 4

MODULES OF INSTRUCTION 7

PHYSICAL RESOURCES REQUIRED 9

MODULES FOR INCLUSION IN EACH MOBILE UNIT INCLUDING EQUIPMENT LISTS 11

STAFFING REQUIREMENTS 28

SCHEDULING PROTOTYPES 29

LABORATORY SPECIFICATIONS 34

ECONOMIC FACTORS 36

A SUMMARY OF CONCLUSIONS 39

REFERENCE SOURCES 41

INTRODUCTION

This study was commissioned to determine the feasibility of using mobile industrial education and home economics laboratories to provide on site instructional facilities for junior high schools which do not have sufficient populations to warrant the construction of more permanent laboratories.

Major focuses were:

1.) the flexibility of such mobile units in terms of program;

2.) the ease of mobility of the units;

3.) the durability of the units;

4.) the costs of investing in mobile units; and

5.) the extended costs of utilization.

PURPOSE OF THE STUDY

The purposes of the study were:

1.) To identify modules of instruction within the present junior high industrial education/home economics program which would be offered through the use of mobile laboratories.

2.) To describe the range of physical resources required to support each module of instruction.

3.) To identify the different curriculum modules that could be included in each mobile laboratory.

4.) To detail staffing requirements.

5.) To develop prototype schedules which indicate how the laboratories might be shared.

6.) To develop laboratory specifications for each mobile unit.

DEFINITION OF TERMS

Fixed site laboratories - these are permanent structures constructed on fixed foundations.

Portable laboratories - these are structures which may be moved if they are loaded on to a trailer unit. They are not designed for frequent moves.

Mobile laboratories - these are structures which are permanently mounted on a trailer chassis with wheels and are intended for frequent movement.

SCOPE OF THE INVESTIGATIONS

The investigations were restricted to the following:

1.) Institutions using mobile laboratories

1.1 The Pembina Valley and Tiger Hills school divisions in Manitoba have been using mobile units for five years to deliver senior high school industrial arts and home economics courses to students in three rural high schools. Our study team inspected these facilities, interviewed instructors and central office personnel and concluded that the needs of that student population are being met. Additionally, the units did not appear to have more than the normal wear and tear in spite of semi-annual moves.

1.2 The County of Leduc in Alberta has purchased a mobile unit for senior high school beauty culture and is considering expanding into more mobiles. Their short term assessment of the utility of such facilities is positive.

1.3 N.A.I.T. has developed a mobile carpentry laboratory. This unit requires a field component in order to provide instructional space for students.

2.) Manufacturing possibilities

2.1 A number of possibilities with respect to manufacturing were explored. Private firms are available for the design and manufacture of mobile units. Several of these are actively involved in the development of mobile teaching stations for national and international markets. Additionally it

would appear that the construction of mobile units is possible through the same work force that a school board would employ for the construction of portable classrooms.

3.) Consultations

3.1 The superintendents of schools for Tiger Hills and Pembina Valley school divisions in Manitoba were enthusiastic about the practicality, durability and mobility of mobile units.[1]

3.2 Several Alberta Education personnel and teaching personnel were consulted on their attitudes toward the use of mobile laboratories as industrial education/home economics teaching stations. Their responses were cautious. The main constraints identified were; possible space inadequacies, the ability of teachers to adapt and the difficulty in modifying existing programs.

3.3 Other agencies contacted to determine what the space constraints were included the Alberta Department of Highways and the Alberta Worker's Health, Safety and Compensation Occupational Hygiene Branch.

3.4 Lab Volt (Quebec) Ltd. was asked to provide interior layouts for mobile units that were able to meet the general specifications set by the study team. The following units were presented:

3.4.1 home economics including food preparation and sewing areas;

3.4.2 graphics communications including drafting, photography and graphics;

3.4.3 electricity, electronics and computers;
3.4.4 power including small engines and pneumatics;
3.4.5 materials including earths, plastics, woods, metals and lapidary.

4.) Literature review

4.1 An educational literature review for the period 1970-1981 resulted in a minimum number of articles. The following paraphrased views are included:

- Cost effectiveness is questionable. (Petty, 1978)[2]
- Systems in sixteen states using a total of fifty mobile labs offered no complaints. Some systems were planning on expanding. However, the lack of complaints may not necessarily signify mobile lab efficacy but may result from an unwillingness to share information that is negative. (Howard, 1973)[3]

MODULES OF INSTRUCTION

Objective - to identify modules of instruction within the present junior high industrial education/home economics which could be offered through the use of mobile laboratories.

1.) The mobile units can be designed to accommodate any of the modules in junior high school industrial education and the junior high school home economics program. Several factors should be considered before particular sections of the program are selected for use.

1.1 The amount of student work space and storage space required for safety and program needs.

1.2 The qualifications of the instructors and the interests of the students and the community.

1.3 The possibilities of the concepts being taught in related courses.

1.4 The degree to which the units or modules meet all three junior high school objectives:

1.1.1 personal growth
1.1.2 career exploration
1.1.3 occupational skills[4]

For the home economics program, units can easily be designed to provide sufficient kitchen spaces or sewing spaces for either the foods or clothing and textiles sections. If a module approach is desirable it is also feasible to develop a laboratory with a combination of three kitchens and ten sewing machines to provide for both components of the

home economics course.

The industrial education modules which can be most easily adapted to mobile laboratories include: power mechanics, electricity, electronics, computers, plastics, printing, photography, technical drawing and the synthesizing modules. Woods and metals can also be included provided that space constraints are acknowledged. Earths, leather, and textiles can easily be taught in a mobile unit. However, these modules could be excluded provided they are offered through the art program.

PHYSICAL RESOURCES REQUIRED

Objective - To describe the range of physical resources required to support each module of instruction.

Mobile laboratories impose several space limitations that affect the size, quantity and location of equipment within the lab. Additionally, mobility itself demands some special requirements in physical design.

1.) The following requirements must be considered in designing a mobile unit.

1.1 Current Alberta highway regulations restrict the width of mobile trailers to sixteen feet. Therefore the interior useable space would range from 70 to 100 m^2 per unit.

1.2 Frequent movement of units this size require construction specifications which ensure that the physical structures will last for a minimum of twenty years. These specifications include a steel undercarriage to reduce twisting, multiple wheel independent suspension to compensate for uneven road beds and metal strapping to reinforce the connecting surfaces between the floor, the walls and roof.

1.3 Because space is at a premium, consideration should be given to alternative heating systems such as electrical heat pumps or radiant heat rather than gas fired convection heating systems. These alternative systems would require less space. If the units are well insulated the cost differences may not be too great.

1.4 Any air filtration units required for dust and fumes removal should be designed to minimize heat loss.

1.5 A receiving concrete pad and a service connection unit will have to be constructed at each user site. A fixed or mobile unheated storage unit would also be desirable.

2.) Minor program modifications may occur as a result of the equipment chosen. The following criteria should be considered in selecting equipment for each module of study.

2.1 Programmed learning kits economize on space. Several commercial firms market quality programs in the power technology area.[5]

2.2 Reduced size models can be used to illustrate the same principles as the actual industrial piece of equipment.

2.3 Simulations may be developed through the use of audio visual and micro computer technology to provide acceptable alternatives to "hands-on" activities.

2.4 Smaller complex machines should be considered whenever they can provide a similar experience and product.

MODULES FOR INCLUSION IN EACH MOBILE UNIT

Objective - To identify the different curriculum modules that could be included in each mobile laboratory.

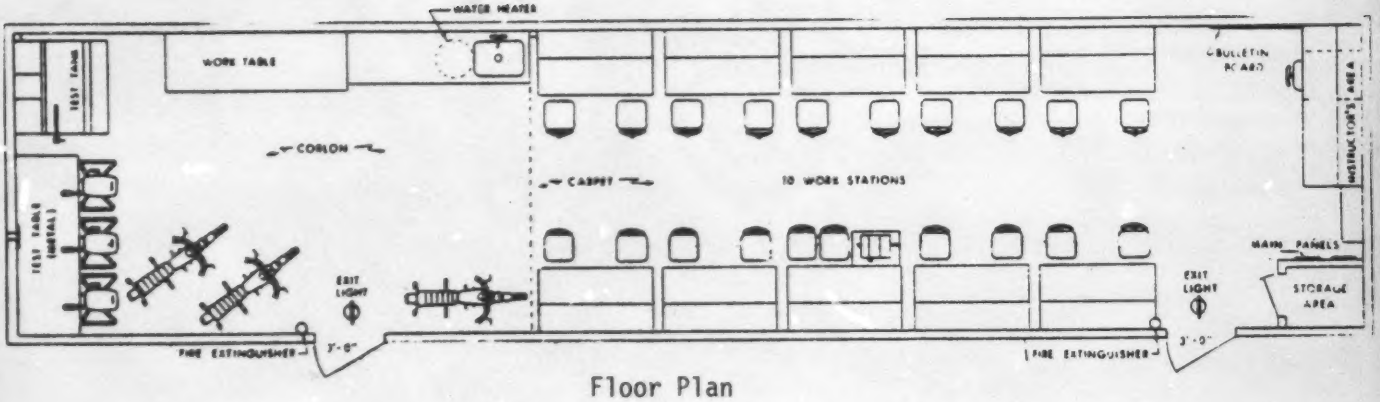
Several possibilities exist when considering which curriculum modules to include in mobile units.

One private company has developed layouts which meet either Manitoba or Alberta curriculum requirements. New layouts designed to meet specific requirements could easily be drawn.

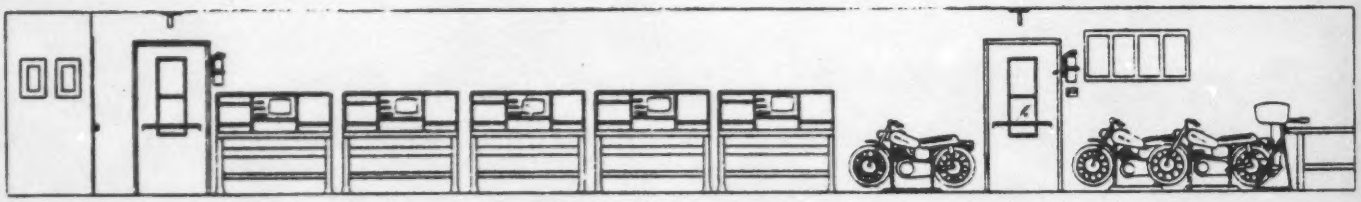
1.) The following drawings are printed with permission from Lab-Volt Ltd. and are intended to serve only as illustrations of possible mobile laboratories. These cannot be used for construction by any other supplier without first receiving written authorization from the above mentioned company.[6]

2.) The equipment lists that have been developed identify the majority of the tools and utensils required for the Alberta Junior High School curriculum. Individual instructors may find it desirable to add or delete items.

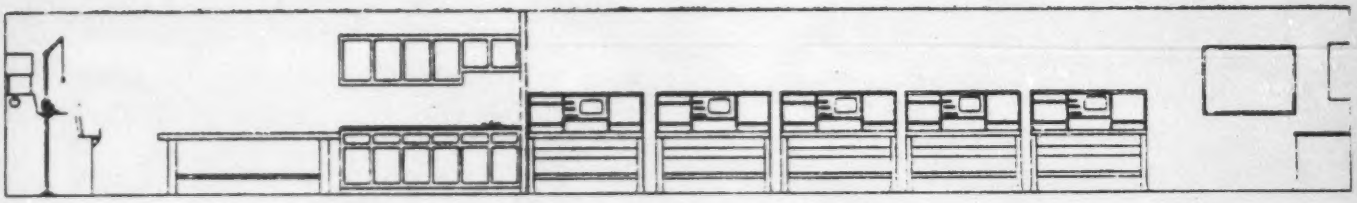
POWER MECHANICS



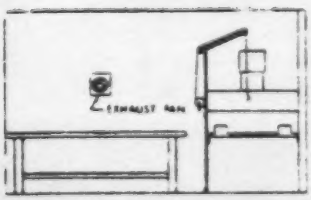
Floor Plan



Right Side Interior Elevation



Left Side Interior Elevation

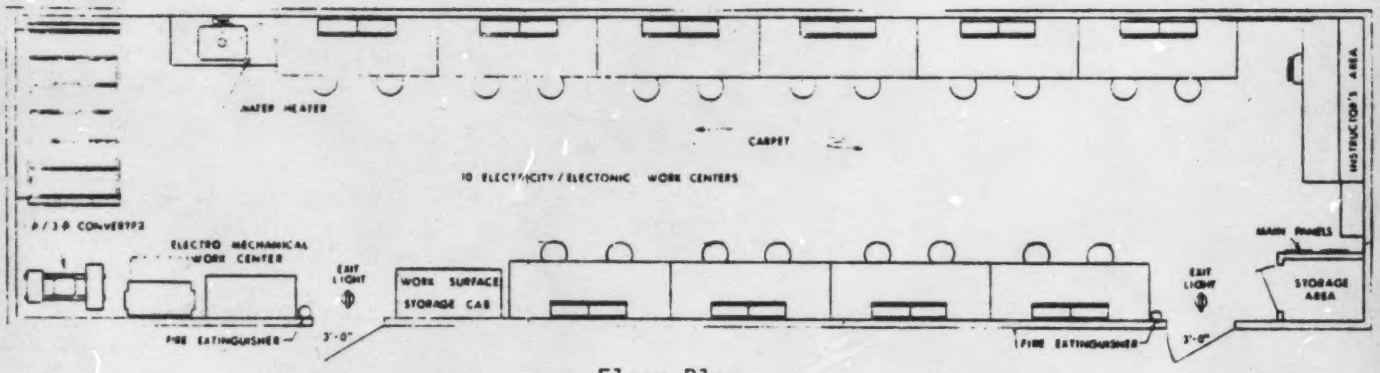


Front Interior Elevation

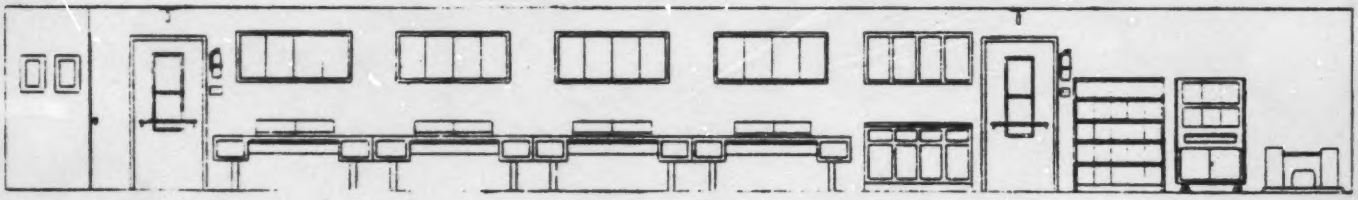
POWER & ENERGY

ITEM #	QUANTITY	DESCRIPTION
1	10	SR-100 Student Work Stations to Accommodate 20 Students Including the Following: (Ken Cook or alternate) Course 1 - Small Engine Technician Course 2 - Marine Engine Technician Course 3 - Wankel Engine Technician Course 4 - Motor-cycle Technician Course 5 - Automotive Lecture's Program
2	200	Sets of Work Sheets & Examination Material For Each Course
3	1	Test Tank c/w Exhaust Fan
4	1	Test Table
5	1	Exhaust Fan
6	1	Stainless Steel Sink
7	1	Hot Water Tank 15 gal.
8	1	Fluidics Kit
9	1	Alternate Energy Source Kit

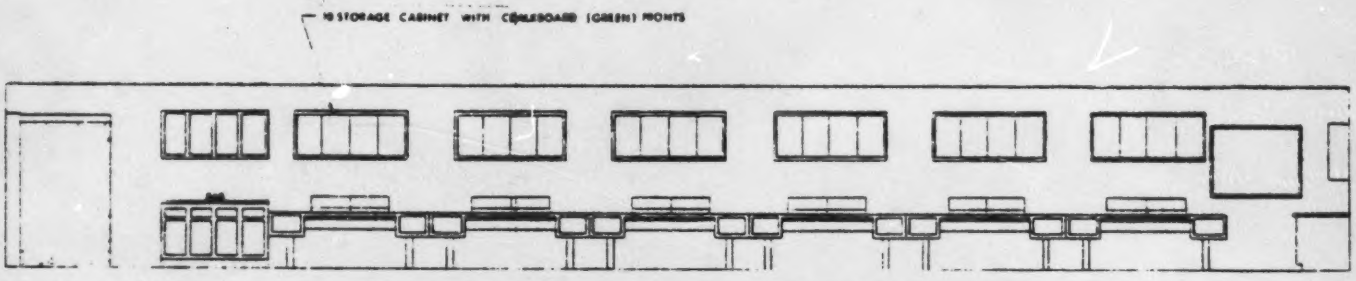
ELECTRICITY, ELECTRONICS, COMPUTERS



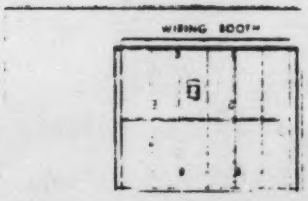
Floor Plan



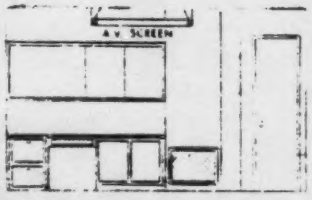
Right Side Interior Elevation



Left Side Interior Elevation



Rear Interior Elevation



Front Interior Elevation

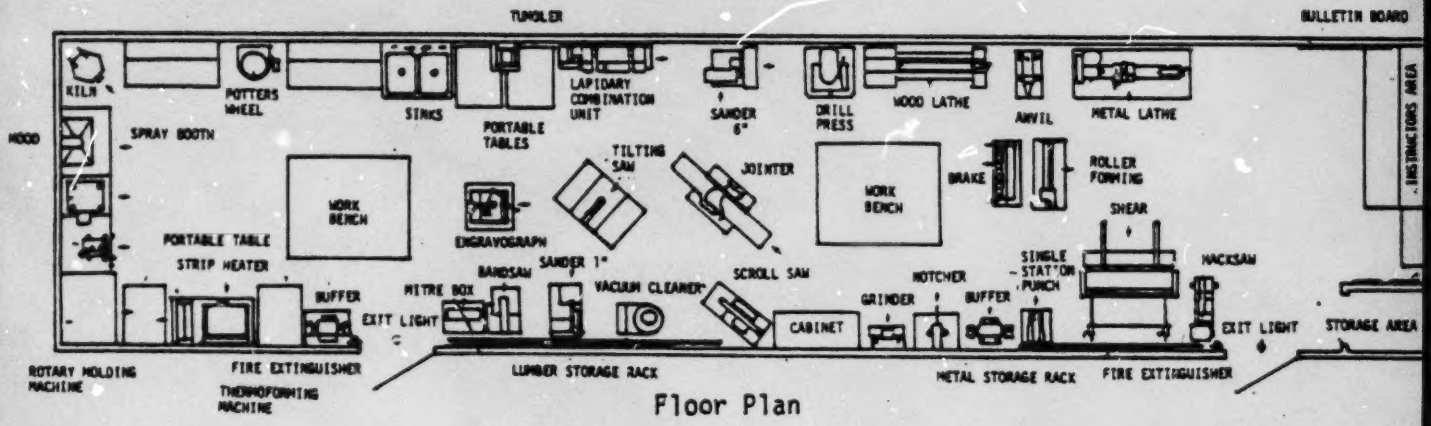
ELECTRICITY, ELECTRONICS & COMPUTERS

ITEM #	QUANTITY	DESCRIPTION
1	20	Student Chairs, AX 11799-01
2	1	Electromechanical System, (Lab Volt or alternate, including the following equipment:
		Mobile Console Storage Cabinet Direct Current Machine Squirrel Cage Induction Motor Wound Rotor Machine Synchronous Machine Capacitor Start Motor Capacitor Run Motor Universal Motor Repulsion/Induction Motor Variable Resistance Variable Inductance Variable Capacitance Transformer DC Volt-Ammeter AC Ammeter AC Voltmeter Single-Phase Wattmeter Three-Phase Wattmeter Synchronizing Module Three-Phase Rheostat Three-Phase Power Supply Electrodynamometer Precision Tachometer Leads Timing Belt SCR Speed Control Student's Manual Instructor's Manual

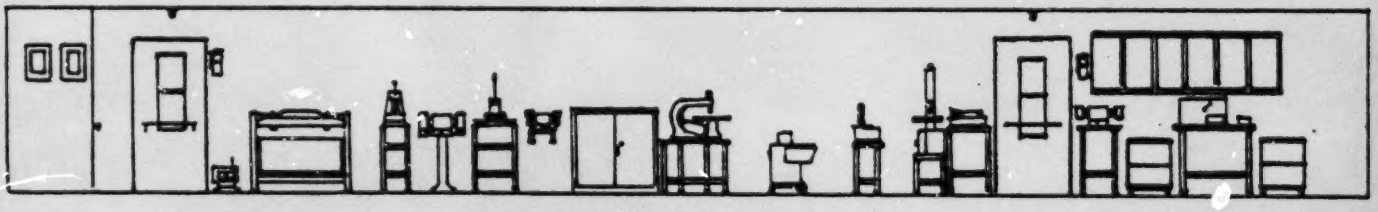
ELECTRICITY, ELECTRONICS & COMPUTERS

ITEM #	QUANTITY	DESCRIPTION
3	10	Two Student Electricity/Electronics Learning Work Centers (Lab Volt or alternate) composed of the following: Bench Cabinet for PES Kit 1213, model 1325-1 Legs for table, model 1320 Maple table top 2' 1/2 x 6', model 826 Tunnel Tunnel Volt-Ohmmeter Panel Meter Power Supply Power Supply Combination Generator Oscilloscope PES Kit with Connector Board, model 1213 Expansion Panel Security Circuit Tunnel Module Component Parts Introduction to Electricity/Electronics
4	200	Student Work Books for 555 Program
5	75	Student Work Books for 506 Program
6	25	Student Work Books for Practical Electronics Volume 1
7	1	Rotoverter 5.3 kVA, Type 2D
8	1	Industrial Wiring Booth
9	2	Micro Computer Instructional Kits

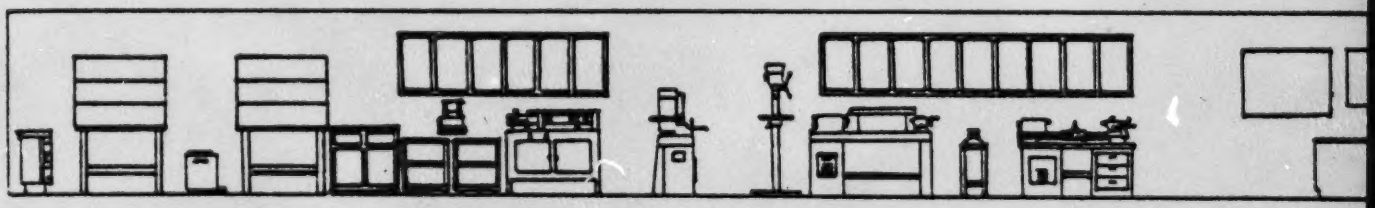
MATERIALS



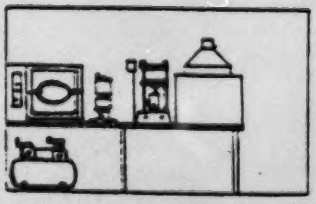
Floor Plan



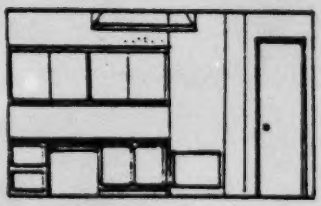
Right Side Interior Elevation



Left Side Interior Elevation



Rear Interior Elevation



Front Interior Elevation

MATERIAL HANDLING

ITEM #	QUANTITY	DESCRIPTION
1	1	Kiln, Top Loading with Pyrometer
2	1	Pugmill with Vacuum
3	1	Potter Wheel, 200 W, 115 Vac
4	1	Stool
5	2	Shelf & Table
6	1	Stainless Steel Sink with Clay Trap
7	1	Spray Booth & Ventilation Hood
8	1	Asbestos Glove
9	1	Compressor 1 hp 1 cyl. with Quick Disconnect Fitting Hose 15 ft., Nozzle, Tire Chuck Release Valve
10	1	Injection Molding Machine & Molding Kit
11	1	Rotational Molding Machine & Supply Kit
12	1	Thermoforming Machine & Kit
13	1	Strip Heater
14	1	Hydraulic & Laminating Press
15	1	Buffer & Dust Collector
16	1	Engravograph with Letter Set, Dept. Gauge & 3 Engraving Tools
17	9	Portable Tables with Casters
18	1	Combination Unit with Floor Stand & Recirculating Pump
19	1	Tumbler

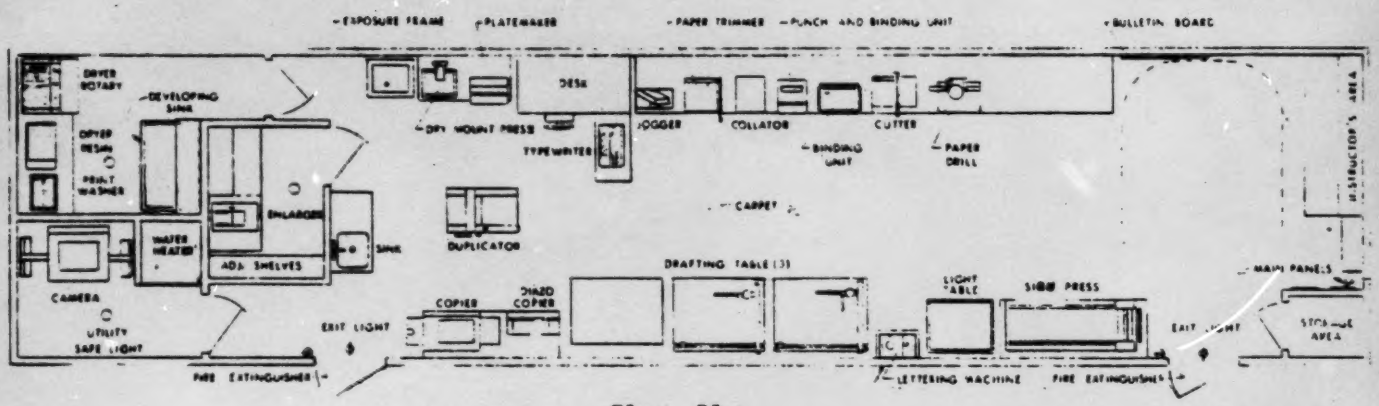
MATERIAL HANDLING

ITEM #	QUANTITY	DESCRIPTION
20	1	Drill Press 6 Speed 3/4 hp
21	1	Grinder with Pedestal & Safety Shield
22	1	Router Heavy Duty
23	1	Band Saw 380 mm
24	1	Tilting Saw 245 mm with Carbide Blade
25	1	Jointer 8" Blade
26	1	Sander 1"
27	1	Sander 6"
28	1	Flamable Storage Cabinet
29	1	Bayonet Saw
30	1	Portable Sander 3" x 21"
31	1	Sander
32	1	Vacuum Cleaner
33	1	Mitre Box
34	1	Scroll Saw
35	1	Lathe Wood with Motor 3/4 hp, Magnetic Starter Tool Rest 4", Tool Rest 12" & Chuck 12 mm, Plate 3", support right angle
36	1	Lathe Wood Chisel Kit
37	1	Guard For Circular Saw
38	4	Vises (Bench)
39	1	Drill Portable
40	1	Bench 4 Men
41	1	Wood Rack
42	1	Complete Set of Tap & Dies M2 x 0.04 (18 sizes)

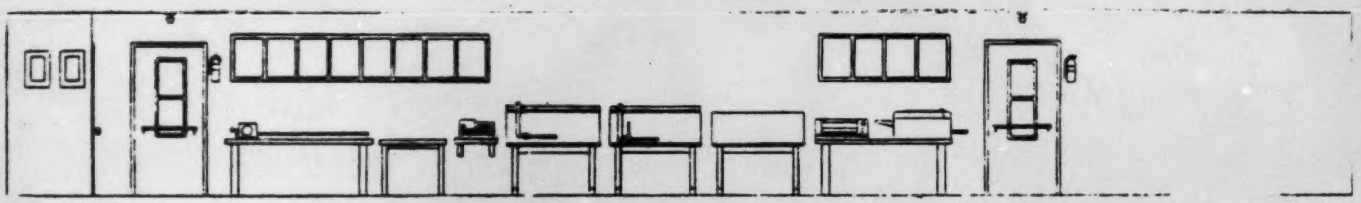
MATERIAL HANDLING

ITEM #	QUANTITY	DESCRIPTION
43	1	Drill Set, Metric, Letter & Number (1-13 mm/1/2 mm) (A-Z) (1-80)
44	1	Brake
45	1	Lathe Cabinet c/w Taper Attachment, Large Face Plate, Boring Tool Type B, Knurling Tool, Universal Chuck 3 Jaw, Drill Chuck 1/2 Cap, Threading Tool, Straight Shank Tool Holder Right Hand Tool Holder Left Hand Tool Holder Ball Bearing Live Center Cut-Off Tool Holder Metric Transposing Gear Hardened & Ground Bedways
46	1	Portable Spot Welder
47	1	Bender with Bender Pak & Stand
48	1	Power Hacksaw Floor Model
49	1	Press Drill
50	1	Buffer, Buffing Wheel, Wire Wheel
52	1	Vise Machinist
53	1	Shear Portable
54	1	Foot Operated Shear
55	1	Roller Forming with Stand
56	1	Bench 4 Persons
57	1	Punch Press # 2 c/w Stand & Punch Pack 3/64"-1/2
58	1	Metal Rack

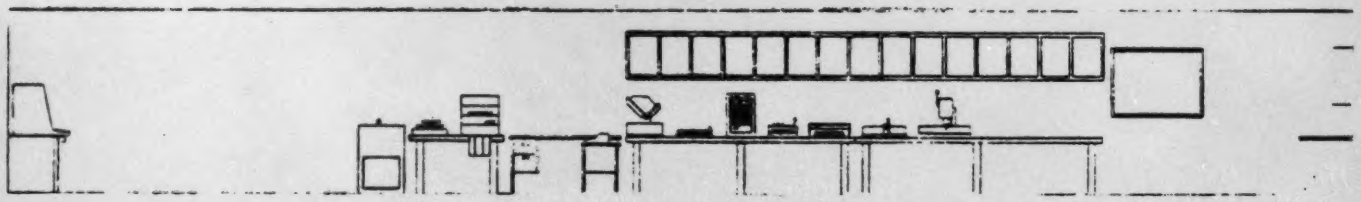
GRAPHICS COMMUNICATIONS



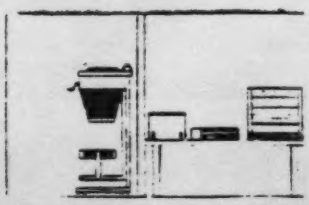
Floor Plan



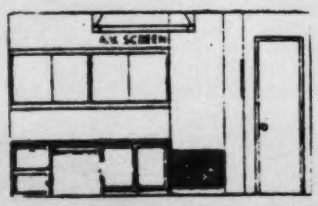
Right Side Interior Elevation



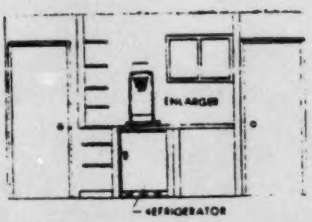
Left Side Interior Elevation



Rear Interior Elevation



Front Interior Elevation



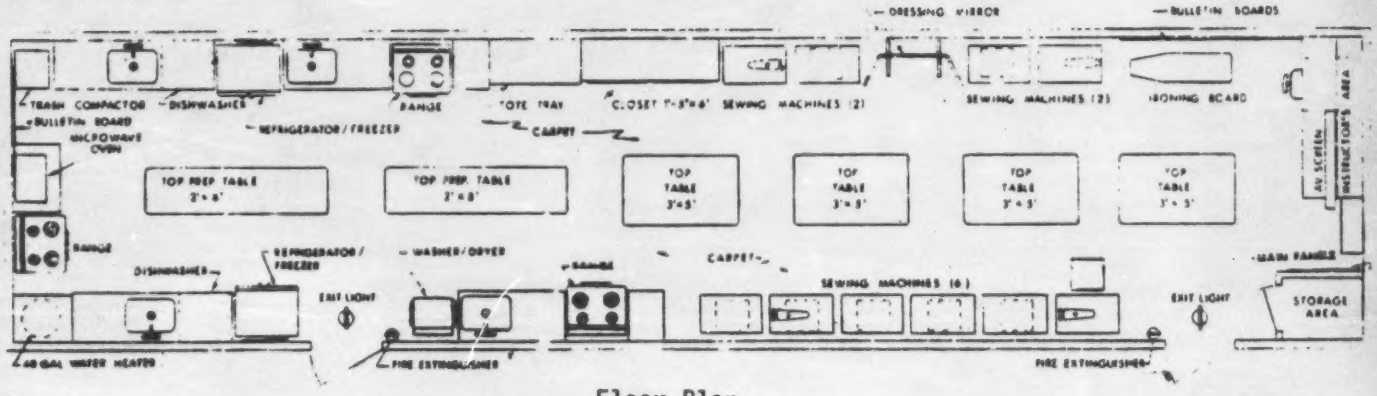
GRAPHICS COMMUNICATIONS

ITEM #	QUANTITY	DESCRIPTION
1	1	Paper Cutter
2	1	Duplicator
3	1	Exposure Frame
4	1	Sign Press with Bench & Font
5	1	Punching & Binding Machine
6	1	Binder
7	1	Lettering Machine with One Font
8	1	Typewriter
9	1	Light Table
10	1	Silk-Screen Kit
11	1	Collator
12	1	Paper Trimmer
13	1	Paper Drill
14	1	Vertical Camera
15	1	Copier
16	1	Plate Maker
17	1	Jogger
18	1	Developing Sink
19	1	Camera 35 mm With Assessories
20	2	Camera Yashica
21	1	Camera Twin Lens
22	1	Dryer Rotary
23	1	Dryer Resin Coated Print Paper
24	1	Electronic Flash Tilting

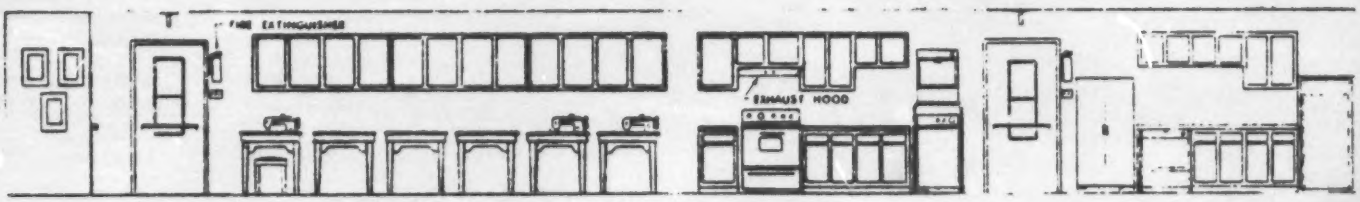
GRAPHICS COMMUNICATIONS

ITEM #	QUANTITY	DESCRIPTION
25	1	Enlarger 50 mm
26	1	Exposure Meter
27	1	Lighting Kit
28	1	Press Junior
29	1	Slide Copier
30	1	Refrigerator 5.3 cu. ft.
31	3	Safe Light
32	2	Timer Darkroom
33	1	Tripod Heavy Duty
34	1	Washer Print
35	1	Camera 35 mm
36	2	Drafting Machine
37	3	Drafting Table, Lamp & Stool
38	1	Track Drafter
39	1	Lettering Machine c/w Cleaning Kit
40	1	Blueprint Machine
41	1	Set of Curtains

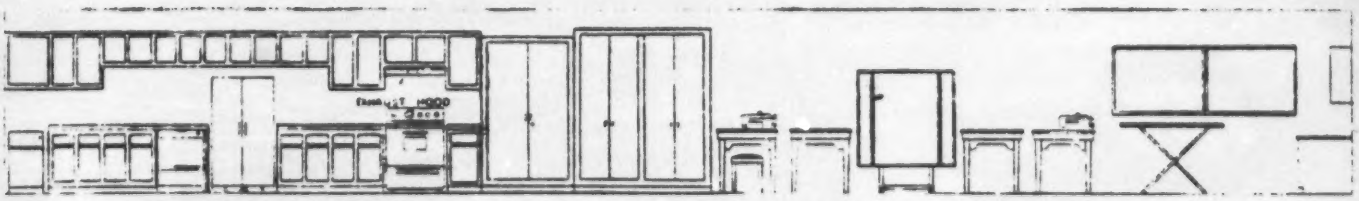
HOME ECONOMICS



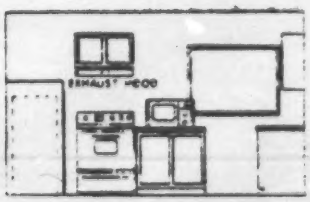
Floor Plan



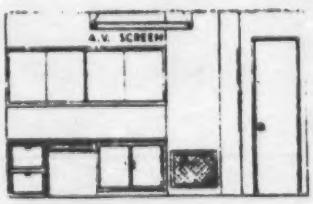
Right Side Interior Elevation



Left Side Interior Elevation



Rear Interior Elevation



Front Interior Elevation

HOME ECONOMICS

ITEM #	QUANTITY	DESCRIPTION
1	1	Microwave Oven
2	3	Free Standing Range with Oven
3	2	Side by Side Refrigerator/Freezer
4	4	Garbage Disposal
5	1	Trash Compactor
6	2	Dishwasher Under Counter
7	3	Exhaust Hood
8	1	Clothes Washer
9	1	Clothes Dryer
10	1	Stack Rack
11	4	Stainless Steel, Single Compartment Sinks with Fittings
12	2	Thick Oak Top Preparation Table - 8' x 24" x 1 3/4"
13	4	Maple Top Tables - 3' x 5'
14	1	Tote Tray Cabinet with 48 Tote Trays
15	3	Bulletin Board - 3' x 4'
16	1	Closet - 2' x 6' x 7'
17	1	3 Way Roll Around Dressing Mirror
18	1	Ironing Board
19	1	Steam and Dry Iron
20	10	Sewing Machines with Attachments, Complete with Cabinet & Stools
21	4 sets	Aluminum Cookware (10 pcs.)
22	4 sets	Stainless Steel Flatware (8 places)
23	2 sets	Tableware (65 pcs.)

HOME ECONOMICS

ITEM #	QUANTITY	DESCRIPTION
24	4 Sets	Cutlery (5 pcs.)
25	2	Electric Coffee Pot 12-36 Cups
26	4	Electric Mixer 10 Speeds
27	1	Blender
28	2	Thimble Assortment (12 pcs.)
29	8	Reversible Tape Measures 6'
30	4	Reversible Tape Measures 6' (Metric)
31	8	Tracing Kit
32	2	Pin Type Skirt Marker
33	8 Pairs	Dress Making Shears 9"
34	3	Ironing Board Pads
35	8	Sewing Circle
36	4 Pairs	Salt & Pepper Shakers
37	2	Candy Thermometers
38	2	Meat Thermometers
39	2	Chopping Blocks
40	8	Pot Holders
41	2	Cake Decorator Sets
42	1	Cookie Gun
43	1 Set	Cake & Sandwich Cutter
44	4	Flour Sifters
45	4	Measuring Cups 16 oz.
46	4	Electric Kettles
47	variable	Accessories including simple tools, utensils and containers.

After reviewing the physical requirements and the industrial education and home economics courses for the junior high school the following mobile units should be considered for possible development. The number of mobile units developed by a school jurisdiction will depend on the cooperation of Alberta Education in approving modifications to existing curriculum requirements as well as the jurisdictions needs.

1.) A power mechanics laboratory including small engines, fluid power, mechanical power, reaction propulsion, alternate energy sources.

2.) An electricity, electronics, computers laboratory.

3.) A materials laboratory including woods, metals and one or more of earths, plastics, leather and textiles.

4.) A graphics communications laboratory including technical drawing, photography and printing.

5.) A food science, clothing and textiles laboratory.

STAFFING REQUIREMENTS

Objective - To detail staffing requirements.

Mobile laboratories do not differ significantly from regular stationary classrooms when basic staffing requirements are considered. Qualified, certificated personnel must be engaged. However, several points should be considered if mobile laboratories are to be utilized.

1.) The teacher must either move with the unit or qualified teachers must be present in each participating school.

1.1 If the teacher moves with the unit additional commuting costs may have to be considered by the educational jurisdiction.

1.2 If qualified home economics or industrial education teachers are assigned to each participating school they will be required to teach other subjects when the laboratories are absent unless they are hired on part time contracts. Difficulties may also be encountered with respect to inventory control due to several teachers using the laboratory at different times.

2.) Teachers selected should possess strengths in being able to modify curriculum and develop innovative solutions to unanticipated problems.

3.) The teachers must be committed to a multiple activity or module approach to instruction. This could be more difficult to achieve in home economics where the curriculum has not been adapted into modules.

SCHEDULING PROTOTYPES

Objective - To develop prototype schedules to indicate how the laboratories might be shared.

There are a number of variables which can be altered when scheduling is developed:

1. The number of available mobile units.
2. The number of participating schools.
3. The length of the instructional period.
4. The minimum recommended instructional time.
5. The rotation time for a unit to return to its original destination.
6. The number of students who can be accommodated per class.
7. The number of students and grades who are eligible for instruction.
8. The development of complementary options which do not require laboratories.

Two prototype schedules have been developed as examples of the sharing possibilities.

Schedule A

1. Assumptions

   1.1 four laboratories will be available

   1.2 seventy-five hours is the minimum yearly instruction time

   1.3 a mean of 16 students per class will be registered

Formula

Maximum students served per school = M x N x i

M = mean class size

N = number of single units

$$i = \left[\left(\frac{\text{1000 hours per year x rotation time in years}}{\text{number of participating schools}}\right) - 10\right] + 75$$

round i down to the nearest whole number

SCHEDULE A

PROTOTYPE SCHEDULES FOR SHARING PORTALABS AMONG SCHOOLS

# OF SCHOOLS	MAXIMUM # OF STUDENTS Per School	# OF LABS	LENGTH OF STAY 5 HRS/SCHOOL DAY	DOWN TIME	INSTRUCTION TIME	ROTATION TIME
2	384	2 DOUBLE 4 SINGLE	(500 HRS) 100 DAYS	2 DAYS	(490 HRS) 98 DAYS	1 YEAR
3	256	2 DOUBLE 4 SINGLE	(330 HRS) 66 DAYS	2 DAYS	(320 HRS) 64 DAYS	1 YEAR
4	192	2 DOUBLE 4 SINGLE	(250 HRS) 50 DAYS	2 DAYS	(240 HRS) 48 DAYS	1 YEAR
5	128	2 DOUBLE 4 SINGLE	(200 HRS) 40 DAYS	2 DAYS	(190 HRS) 38 DAYS	1 YEAR
6	128 256	2 DOUBLE 4 SINGLE	(165 HRS) 33 DAYS (330 HRS) 66 DAYS	2 DAYS 2 DAYS	(155 HRS) 31 DAYS (320 HRS) 64 DAYS	1 YEAR 2 YEARS
7	192	2 DOUBLE 4 SINGLE	(285 HRS) 57 DAYS	2 DAYS	(275 HRS) 55 DAYS	2 YEARS
8	192	2 DOUBLE 4 SINGLE	(250 HRS) 50 DAYS	2 DAYS	(240 HRS) 48 DAYS	2 YEARS
9	128 256	2 DOUBLE 4 SINGLE	(165 HRS) 33 DAYS (330 HRS) 66 DAYS	2 DAYS 2 DAYS	(155 HRS) 31 DAYS (320 HRS) 64 DAYS	2 YEARS 3 YEARS
10	192	2 DOUBLE 4 SINGLE	(300 HRS) 60 DAYS	2 DAYS	(290 HRS) 58 DAYS	3 YEARS
11	192	2 DOUBLE 4 SINGLE	(270 HRS) 54 DAYS	2 DAYS	(260 HRS) 52 DAYS	3 YEARS
12	192	2 DOUBLE 4 SINGLE	(250 HRS) 50 DAYS	2 DAYS	(240 HRS) 48 DAYS	3 YEARS
13	128	2 DOUBLE 4 SINGLE	(230 HRS) 46 DAYS	2 DAYS	(220 HRS) 44 DAYS	3 YEARS
14	128	2 DOUBLE 4 SINGLE	(210 HRS) 42 DAYS	2 DAYS	(200 HRS) 40 DAYS	3 YEARS
15	128	2 DOUBLE 4 SINGLE	(200 HRS) 30 DAYS	2 DAYS	(190 HRS) 38 DAYS	3 YEARS

Schedule B

1. Assumptions

   1.1 four laboratories will be available

   1.2 each module requies twenty-five hours of instruction

   1.3 a mean of 18 students per class

   1.4 a teacher is assigned 1400 minutes of instruction time

SCHEDULE B

PORTA LAB INSTRUCTION TIME

18 STUDENTS/CLASS TEACHER TIME 1400 MIN/WEEK

TIME/DAY	NO. OF CLASSES PER DAY	TOTAL NO. OF STUDENTS PER DAY	TIME TO COMPLETE IN WEEKS	POSSIBLE NO. OF MOVES
TOTAL 25 HOURS				
140 min/day/ class	2	36	2.14	16
93 min/day/class	3	54	3.1	11
70 min/day/class	4	72	4.22	8
TOTAL 50 HOURS				
140 min/day/class	2	36	4.3	8
93 min/day/class	3	54	6.2	6
70 min/day/class	4	72	8.4	4
TOTAL 75 HOURS				
280 min/day/class	1	18	3.21	11
140 min/day/class	2	36	6.4	6
93 min/day/class	3	54	9.3	4
70 min/day/class	4	72	12.8	3

LABORATORY SPECIFICATIONS

Objective - To develop laboratory specifications for each mobile unit.

The development of suitable laboratory specifications is the responsibility of individual school jurisdictions which are free to engage whatever professional services they may require. The following suggestions may be of value in preparing specifications.

1.) The mobile unit

- 1.1 The unit should be developed so that mobility is not compromised.
- 1.2 The longevity of mobile units is dependent on quality construction.
- 1.3 Interior plumbing will prevent water problems.
- 1.4 Heating units should use minimum space.
- 1.5 Electrical wiring should be shielded from accidental puncture.
- 1.6 Useable floor space must be maximized. A mobile teaching station combined with a mobile or fixed storage unit would provide maximum space.

2.) Interior spaces and equipment

- 2.1 Consult with practitioners to establish functional minimum requirements for circulation space, equipment and storage.
- 2.2 Purchase equipment that demands simple electrical requirements e.g. 110/220 wiring, single phase.
- 2.3 Purchase equipment which is durable yet economizes on space.
- 2.4 Kits and learning packs help conserve space.
- 2.5 Equipment selected should require minimum storage for support materials.
- 2.6 Precut materials would facilitate project work.

3.) Support components

3.1 A concrete support pad will be required.

3.2 An umbilical system for utilities will be required.

3.3 A basic on site or mobile storage unit may be desirable.

3.4 A communications system hookup may be desirable.

ECONOMIC FACTORS

The feasibility of utilizing mobile laboratories must be considered in economic terms as well as program and personnel suitability. The following economic factors should be weighed before deciding on whether to use these units for the delivery of educational opportunities.

1.) Useful life - Fixed site laboratories are assessed a life of 50 years if the construction is of masonry. The mobile units would only be assessed a maximum life of 20 years or less for capacity purposes.

2.) Period of demand - If a youthful population continues to be generated in sufficient numbers within a given area for a period in excess of 20 years fixed site laboratories can be a sound investment. However, if populations mature or decline, mobile units may be more practical.

3.) Transportation costs - Bussing costs both in financial terms and educational time lost from the instructional day as a result of centralizing students to a fixed laboratory must be balanced against the potential costs for commuting instructors and periodic relocation of mobile laboratories. Mobile laboratories can be moved quickly, easily and economically.

4.) Initial investment - The total cost per m^2 for fixed site units and mobile units are similar. However, the investment required to construct two fixed laboratories would be sufficient to purchase four independent mobile laboratories.

5.) Government funding for mobile units will be somewhat less than that provided for fixed sites.[7]

6.) Convertibility - Fixed site units are generally difficult to dispose of if enrollments decline. Mobile units could possibly be marketed to other jurisdictions for educational or private purposes because of the ease of relocation.

7.) Maintenance - Information on maintenance is based on limited experience, however, indications are that mobile unit maintenance costs do not vary greatly from fixed site laboratory costs.

A COMPARISON CHART

	MOBILE LABORATORY	FIXED SITE LABORATORY
1. Multi-purpose Home Economics		
1.1 Size	100 m^2	140 m^2 (8)
1.2 Total cost	$125,000 equipped	$180,000 equipped
1.3 Capacity	20 students maximum	20 students plus
1.4 Government Support	$520/$m^2$	$732/$m^2$
1.5 Local Support	$73,000	$77,000
2. Single Station Industrial Education		
2.1 Size	100 m^2	260 m^2 (9)
2.2 Construction Cost	$90,000 without equipment	$260,000 without equipment
2.3 Capacity	20 students maximum	20 students plus
2.4 Government Support	520/m^2	732/m^2
2.5 Local Support	$40,000 per unit plus equipment costs	$69,680 per unit plus equipment costs
3. Bussing	Nil	Based on the distance and frequency of bussing
4. Commuting costs	Based on contractual commitments	Nil
5. Portability	Total	Nil
6. Durability	20 years	50 years
7. Maintenance	Comparable	Comparable
8. Schools served	A possible four per unit per year	One core plus those within bussing distance

A SUMMARY OF CONCLUSIONS

1.) Mobile laboratories, if well constructed, can serve a useful purpose in delivering industrial education and home economics programs to schools whose junior high school populations are not sufficient to support fixed site laboratories. Relocation costs in time, effort and financial expenditure are economical.

2.) The curriculum content and experiences for industrial education and home economics will not have to be altered substantially in order that they may be adapted to the mobile laboratory. However, the number of modules taught might be reduced. The recommended minimum is six modules for a junior high school program.[10]

3.) Although the per m^2 costs are similar and current government funding favours fixed site units, the mobile units can be an economically attractive investment for the following reasons.

3.1 A school jurisdiction may elect to invest in the program one unit at a time thus delaying or reducing the expenditures.

3.2 If population shifts occur the units can be relocated as a response to changing enrollment conditions. Thus the need to build fixed site units is diminished.

3.3 Once a successful prototype has been selected, mass production techniques could be employed to reduce costs.

4.) The major constraints identified are personnel related.

4.1 Loyalty to traditional patterns of curriculum presentation tend to lessen the potential for innovation and adaptability. These are necessary for the successful introduction of mobile laboratories.

4.2 The rate and degree of integration of mobile laboratory teachers into various school staffs may be a source of stress for the instructor.

4.3 Timetabling for mobile unit instruction within and among schools may require a degree of flexibility which strains traditional time allocation patterns.

It would appear that mobile laboratories have the potential to facilitate the delivery of similar education opportunities to the less urbanized areas of this province. The possibilities extend beyond the industrial education and home economics programs at the junior high school level into many other courses where manipulative hardware is an integral part of the course. Examples of other subjects include typing, micro processing, and the whole range of prevocational and vocational programs. A viable delivery system exists,and whether the opportunities or problems are salient is largely a matter of personal perspective.

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8,9.) Alberta Education, School Building Facilities Instructional and Non-Instructional Area Guidelines, 1979.